Long-Term Regular Dental Attendance and Tooth Retention among British Adults: A Cross-sectional Analysis of National Survey Data

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ABSTRACT

Objective: To explore the association between long-term pattern of dental attendance and tooth retention among British adults.

Methods: This study analyzed data from 2970 dentate adults who participated in the Adult Dental Health Survey. Data were collected through home interviews and clinical examinations. Individuals' were categorized into four trajectories according to their responses to three questions on dental attendance over their life span. The four trajectories were always, current, former and never regular attenders. Tooth retention was measured as the number of natural teeth retained and having a functional dentition (20 or more teeth). Associations were examined in regression models adjusted for demographic (sex, age and country of residence), socioeconomic (education, equivalized household income and social class) and clinical factors (untreated caries and periodontal disease).

Results: Never and former regular attenders had fewer teeth retained (Rate Ratios with 95% Confidence Interval: 0.93 [0.89-0.97] and 0.97 [0.96-0.99] respectively) and lower odds of having functional dentition (Odds Ratios with 95% CI: 0.36 [0.22-0.60] and 0.53 [0.34-0.83] respectively) than always regular attenders after adjusting for demographic, socioeconomic and clinical characteristics. However, no differences in number of teeth retained or having a functional dentition were found between always and current regular attenders.

Conclusion: Long-term regular dental attendance was associated with greater tooth retention. Never and former regular attenders had fewer teeth retained than always regular attenders. No difference in tooth retention was found between always and current regular attenders.

INTRODUCTION

Gilbert, et al.[1] defined regular attenders as those who visit the dentist on a regular basis for check-ups regardless of their dental needs, and non-regular attenders as those who visit the dentist occasionally or when they experience a specific dental problem. Regular dental check-ups are thought to serve a double function. First, a primary prevention function through the provision of advice that influences health behaviors to prevent oral diseases. Second, a secondary prevention function through clinical examination to limit the progression of oral diseases and its harmful effect at an early stage.[2] However, systematic reviews evaluating the effects of regular dental attendance on oral health in general, and tooth retention in particular, have been inconclusive.[2-4]

Tooth retention is an effective indicator of oral health which reflects patients' accumulated experience of dental diseases, dentists' attitudes and care philosophy and the delivery of dental services.[5-7] Several longitudinal studies have examined the association between regular dental attendance and tooth retention,[8-12] with all but one[8] showing a positive association after adjustment for confounders. In the Dunedin Study, the longer the regular attendance pattern was maintained over 4 ages (15, 18, 26 and 32 years) the greater the number of teeth preserved.[9] Further analysis of the Dunedin Study identified three dental attendance trajectories from childhood to early adulthood. Regular attenders had fewer teeth lost due to caries than opportunists (who were non-regular attenders even when free dental care was available) but not than decliners (who shifted from regular to non-regular attenders when dental care was no longer provided for free). No difference was found between opportunists and decliners.[10] In Sweden, Astrom, et al.[11] found that adults who remained regular attenders from age 50 to 65 years and those who shifted from non-regular to regular attenders were less likely to report major tooth loss than long-term non-regular attenders. No difference was found between those who shifted from regular to non-regular attenders and those who remained non-regular attenders. In Japan, the number of teeth lost over 10 years was lower in adult regular attenders (those who agreed to visit every 6 months or shorter to undergo maintenance with an appointment adherence rate$\geq$70% over 10 years) than problem-oriented attenders (those who refused to visit the dentist regularly for maintenance and/or only visited when they had a problem). No differences were found between irregular attenders (those with <70% appointment adherence rate) and regular attenders.[12]

From reviewing the above studies, it is clear that only a few have looked at dental attendance trajectories[9-11] and evidence is still inconclusive. This study adds to current knowledge from two

angles. First, by looking at functional dentition as an outcome (in addition to tooth loss), which is arguably a stronger indicator of oral health and adequacy of oral function. Second, by generating evidence from a new setting, the UK, where regular visits are common[13,14] and dental care for adults is co-paid by patients and the National Health System.[15] This study explored the association between trajectories in dental attendance over the life span and tooth retention among British adults.

METHODS

Data source

This study used data from the Adult Dental Health Survey, a nationally representative survey of adults aged ≥16 years residing in private households in England, Northern Ireland, Scotland and Wales. Participants were selected through multi-stage stratified random sampling. In brief, 3666 eligible households participated in the survey (74% response rate) and 6204 (92%) of the 6764 adults living in those addresses were interviewed. During interviews, 5281 adults reported having one or more natural teeth and 3817 (72%) of them agreed to take part in a dental examination.[16]

Of the 3817 participants who were clinically examined, we excluded 847 because of missing data on covariates (income=401 social class=241, education=2 and periodontal disease=310). Thus, the study sample included 2970 dentate adults.

Data collection

Data were collected through home interviews and clinical examinations. During interviews, participants provided information on their demographic characteristics (age, sex and country of residence), socioeconomic factors (social class and education level) and long-term pattern of dental attendance. Education was measured based on the highest qualification obtained (no degree, below degree level, and at degree level or above). Weekly household income, before deductions and from all sources, was extracted from answers to multiple questions. Income data was equivalised using the OECD-modified scale to account for household size. This was done by assigning weights based on size of household and age of members as follow: 1 for the head of household, 0.5 per additional adult and 0.3 per child. Then, total household income was divided by the weighted number of household members.[17] After equivalization, household income was classified into quintiles (£<100, £100-169, £170-240, £241-350, >£350). Social class was measured based on the Registrar General's Social Class, with participants assigned into six categories according to the occupation of the head of the

household. The categories were professional (I), managerial and technical (II), skilled non-manual (IIINM), skilled manual occupations (IIIM), partly skilled occupations (IV) and unskilled occupations (V). For analysis, classes I and II were merged (highest) as were classes IIINM and IIIM, and classes IV and V (lowest).

Three questions allowed classifying participants long-term dental attendance pattern into four distinctive trajectories. The first question was if they "go to the dentist for regular check-up, an occasional check-up or when having trouble with teeth?". Depending on their response, participants were asked one of two follow-on questions. On one hand, individuals who said that they go to the dentist for regular check-up were then asked if "there has ever been a time in your life when you have not been for regular check-up?". On the other hand, individuals who said that they go for an occasional check-up or when having trouble with teeth were then asked if "there has ever been any time in your life when you have been for regular check-up?". Individuals who reported that they go to the dentist for regular check-ups and have been going always for regular check-up were classified as *always regular attenders* (reference group). Those who said that they go for regular check-ups but there has been a time where they were not always regular for check-ups were classified as *current regular attenders*. Those who said that they go for an occasional check-up or when they have a trouble but there has been a time where they were regular for check-ups were classified as *former regular attenders*. Those who reported that they go for an occasional check-up or when they have a trouble and have never been a time where they were regular for check-ups were classified as *never regular attenders*.[18,19]

Dental examinations were conducted by 70 dentists, with participants seated on a chair and using a mirror and CPITN-C probe under illumination by Daray light lamps. Participants' teeth were not brushed nor professionally cleaned prior to examination. All teeth, including third molars were examined. Dental caries was recorded at surface level using the caries into dentine threshold (cavitated lesion). Periodontal examination included the assessment of pocket depth and loss of attachment (LOA) at two sites (mesial and distal) per tooth, buccally on upper teeth and lingually on lower teeth. The mean Kappa scores for the condition of teeth ranged from 0.88 to 0.96 across groups, at tooth level.[16] For this study, the number of teeth and having a functional dentition consisting of 20 or more teeth,[20-22] determined from clinical examinations, were the outcome measures. Dental caries was defined as having one or more teeth with cavitated caries or teeth that

were so broken down, possibly with pulpal involvement, that they were un-restorable. Periodontal disease was defined as having at least one tooth with LOA>=4mm.

Statistical analysis

All analyses were performed in Stata 14, incorporating sampling weights to account for unequal probabilities of selection and non-response, as well as survey design features (clustering and stratification) to produce corrected standard errors and 95% confidence intervals (CI).

We first compared the sociodemographic characteristics of the study sample with those of participants who were excluded from it (edentate or with missing values). These comparisons were carried out using the Chi-squared test. Thereafter, we compared the four long-term dental attendance trajectories in terms of demographic, socioeconomic and clinical characteristics using the Chi-squared test.

The association between long-term dental attendance trajectories and number of teeth was assessed using negative binomial regression as the outcome was a count variable with over-dispersion. Therefore, rate ratios (RR) with 95% CIs were reported. The association between dental attendance trajectories and functional dentition was assessed using binary logistic regression as the outcome was a dichotomous variable. Therefore, odds ratios (OR) with 95% CIs were reported. The modelling strategy was to estimate the crude association between long-term dental attendance trajectories and each outcome (labelled as Model 1A and 2A), and then gradually adjust for potential confounders of the association (regardless of their significance). These confounders were socio-demographic factors (sex, age, country of residence, education, household income and social class) in Models 1B-2B and clinical characteristics (untreated dental caries and periodontal disease) in Models 1C-2C.

RESULTS

This study analyzed data of 2970 dentate adults (47% female). The mean age was 41.5 years (Standard Deviation: 16.2; range: 16-93). The composition of the sample is shown in Table 1. No major sociodemographic differences were found between the study sample and those excluded from it. Most adults were categorized as current regular attenders (31.6%) followed by former, always and never regular attenders (31.0%, 27.9% and 9.5% respectively). The mean number of teeth was 25.0 (SD: 6.0; range: 1-32) and 85.9% of adults had functional dentition.

Significant differences were found between the four dental attendance trajectories. The group of always regular attenders included more women than the remaining three dental trajectories. Also,

always and former regular attenders were younger than current and never regular attenders. As for socioeconomic position, never regular attenders were of lower education, had lower income and were from lower social class than always, current and former regular attenders. Never regular attenders also had more untreated caries and periodontal disease than the other three groups (Table 2).

The association of long-term dental attendance patterns with each outcome is shown in Table 3. Never and former regular attenders had respectively 7% (RR=0.93, 95% CI: 0.89-0.97) and 3% (RR=0.97, 95% CI: 0.96-0.99) fewer teeth retained than always regular attenders after controlling for participants' demographic and socioeconomic factors. However, there was no significant difference between always and current regular attenders in the adjusted model. These associations remained unchanged after further adjustments for clinical characteristics (dental caries and periodontal disease). Never (OR=0.36, 95% CI: 0.22-0.60) and former regular attenders (OR=0.50, 95% CI: 0.32-0.78) also had lower odds of having functional dentition than always regular attenders after controlling for participants' demographic, socioeconomic and clinical factors. However, there was no significant difference between always and current regular attenders in the adjusted model.

DISCUSSION

The study shows that always regular attenders had more teeth retained than never and former regular attenders. However, always regular attenders and current regular attenders had similar tooth retention outcomes. These findings were robust to adjustments for sociodemographic and clinical factors.

Our findings suggest that never and former regular attenders had fewer teeth retained and lower odds of having functional dentition because they lost the benefits that come with regular dental check-ups, such as accessing preventive care and arresting the progression of caries lesions and periodontal diseases which may cause tooth loss.[2-4] Even though our findings were independent of the two most common oral diseases (dental caries and periodontal disease), they represent current not past levels of disease. Only past disease could have led to tooth loss. Thus, our findings assume that current untreated disease is a good proxy for previous disease experience. Further studies should consider the role of other factors in the association between long-term dental attendance and tooth retention, including affordability of care, patients' treatment preferences and dentists' treatment decisions.[5-7]

Interestingly, we found no differences in tooth retention between current and always regular attenders. This finding suggests concurrent exposure to regular attendance may counter exposure to

past negative experiences,[9,11] which is consistent with the critical period model with later effect modifier in life course epidemiology, whereby the effect of an exposure in a specific period of life could be modified by factors acting later in life.[23,24] This argument is supported by findings from life course epidemiology studies in the UK where health behaviors in adulthood were more likely to affect the number of teeth retained at age 50 years than health behaviors at an earlier stage of life[25,26] and proximal socioeconomic conditions more strongly associated with perceived adult oral health than circumstances in early life.[27]

Previous researchers[9,11] have argued that the association between long-term regular dental attendance and tooth retention may be attributed to the "healthy user effect" –the tendency of individuals who seek a single preventive service to additionally undertake other preventive services or engage in other health-promoting behaviors–.[28,29] Therefore, any observational study assessing the effect of a preventive therapy on a health outcome without controlling for further relevant health behaviors (such as healthy diet) will likely exaggerate the resulted effect of the examined preventive therapy.[29] Even though we did not control for the effect of other dental behaviors, such as smoking, sugars intake and toothbrushing frequency, we attempted to limit the effect of these confounders by including adjustments for several demographic and socioeconomic measures since favorable behaviors are usually clustered among healthier individuals, who seem to be younger, female, highly educated and better-off.[30] Although not an ideal approach, including multiple socioeconomic indicators in regression models allowed controlling for the effect of dental behaviors indirectly, as the latter are known to be socially determined.[31]

The study findings have some implications for oral health promotion and future research. Subject to corroboration in new studies, promoting regular dental attendance may help achieving our goal of a future population that can enjoy a healthy functional natural dentition throughout life. Our findings suggest that it is never too late in life to engage in regular dental visits. Further studies with stronger designs, using multiple assessments for dental attendance and tooth retention as well as controlling for other dental behaviors, are needed to corroborate the present findings. It would also be useful to look at the effect of regular dental attendance on edentulousness.

The study has some limitations that need to be considered when interpreting the findings. We used data from the 1998 survey because the questions needed to estimate long-term dental attendance pattern were removed from the questionnaire used in the more recent version of the Adult Dental

Health Survey (2009). However, our findings are still relevant today as the role of behavioral factors in explaining health variations has not changed since they were first identified (sugars intake remains related to dental caries and tobacco smoking to periodontal disease despite changes over time). Also, Scotland was not included in 2009 whereas the 1998 survey collected data from 4 countries, therefore allowing greater generalization. Second, dental attendance trajectories were derived from self-reports collected at a single timepoint, which may be prone to measurement error. However, a study that assessed the validity of self-reports for dental attendance against dental records found that the use of self-reports is sufficiently valid for most research questions.[32]

CONCLUSION

This study shows long-term regular dental attendance was associated with greater tooth retention, both in terms of having more natural teeth and enjoying a functional dentition. Never and former regular attenders had fewer teeth retained than always regular attenders. No difference in tooth retention was found between always and current regular attenders.

CLINICAL RELEVANCE

Scientific rationale

Systematic reviews on the benefits of regular dental check-ups are inconclusive. Recent observational studies suggest that long-term regular attenders have better oral health than non-regular attenders.

Principal findings

Never and former regular attenders, but not current regular attenders, had fewer teeth than always regular attenders.

Practical implications

Regular dental visits for check-ups may provide dental professionals and their patients with opportunities for primary and secondary prevention.

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REFERENCES

1. Gilbert GH, Stoller EP, Duncan RP, Earls JL, Campbell AM. Dental self-care among dentate adults: contrasting problem-oriented dental attenders and regular dental attenders. Spec Care Dentist 2000;20(4):155-163.

2. Riley P, Worthington HV, Clarkson JE, Beirne PV. Recall intervals for oral health in primary care patients. Cochrane Database Syst Rev 201312):CD004346.

3. Davenport CF, Elley KM, Fry-Smith A, Taylor-Weetman CL, Taylor RS. The effectiveness of routine dental checks: a systematic review of the evidence base. Br Dent J 2003;195(2):87-98.

4. Patel S, Bay RC, Glick M. A systematic review of dental recall intervals and incidence of dental caries. J Am Dent Assoc 2010;141(5):527-539.

5. Baelum V, van Palenstein Helderman W, Hugoson A, Yee R, Fejerskov O. A global perspective on changes in the burden of caries and periodontitis: implications for dentistry. J Oral Rehabil 2007;34(12):872-906.

6. Thorstensson H, Johansson B. Why do some people lose teeth across their lifespan whereas others retain a functional dentition into very old age? Gerodontology 2010;27(1):19-25.

7. Fejerskov O, Escobar G, Jossing M, Baelum V. A functional natural dentition for all--and for life? The oral healthcare system needs revision. J Oral Rehabil 2013;40(9):707-722.

8. Gilbert GH, Miller MK, Duncan RP, Ringelberg ML, Dolan TA, Foerster U. Tooth-specific and person-level predictors of 24-month tooth loss among older adults. Community Dent Oral Epidemiol 1999;27(5):372-385.

9. Thomson WM, Williams SM, Broadbent JM, Poulton R, Locker D. Long-term dental visiting patterns and adult oral health. J Dent Res 2010;89(3):307-311.

10. Crocombe LA, Broadbent JM, Thomson WM, Brennan DS, Poulton R. Impact of dental visiting trajectory patterns on clinical oral health and oral health-related quality of life. J Public Health Dent 2012;72(1):36-44.

11. Astrom AN, Ekback G, Ordell S, Nasir E. Long-term routine dental attendance: influence on tooth loss and oral health-related quality of life in Swedish older adults. Community Dent Oral Epidemiol 2014;42(5):460-469.

12. Yoshino K, Ito K, Kuroda M, Sugihara N. Tooth Loss in Problem-oriented, Irregular, and Regular Attenders at Dental Offices. Bull Tokyo Dent Coll 2016;57(1):11-19.

13. Listl S. Inequalities in dental attendance throughout the life-course. J Dent Res 2012;91(7 Suppl):91s-97s.

14. Kino S, Bernabe E, Sabbah W. The role of healthcare system in dental check-ups in 27 European countries: multilevel analysis. J Public Health Dent 2017;77(3):244-251.

15. Boyle S. United Kingdom (England): Health system review. Health Syst Transit 2011;13(1):1-483, xix-xx.

16. Kelly M, Steele JG, Nuttall N, Bradnock G, Morris J, Nunn J et al. Adult Dental Health Survey: Oral Health in the United Kingdom 1998 London: The Stationery Office; 2000.

17. de Vos K, Zaidi MA. Equivalence scale sensitivity of poverty statistics for the member states of the european community. Rev Income Wealth 1997;43(3):319-333.

18. Aldossary A, Harrison VE, Bernabe E. Long-term patterns of dental attendance and caries experience among British adults: a retrospective analysis. Eur J Oral Sci 2015;123(1):39-45.

19. Karimalakuzhiyil Alikutty F, Bernabe E. Long-term regular dental attendance and periodontal disease in the 1998 adult dental health survey. J Clin Periodontol 2016;43(2):114-120.

20. Armellini D, von Fraunhofer JA. The shortened dental arch: a review of the literature. J Prosthet Dent 2004;92(6):531-535.

21. Bernabe E, Sheiham A. Tooth loss in the United Kingdom--trends in social inequalities: an age-period-and-cohort analysis. PLoS One 2014;9(8):e104808.

22. Tan H, Peres KG, Peres MA. Retention of Teeth and Oral Health-Related Quality of Life. J Dent Res 2016;95(12):1350-1357.

23. Kuh D, Ben-Shlomo Y, Lynch J, Hallqvist J, Power C. Life course epidemiology. J Epidemiol Community Health 2003;57(10):778-783.

24. Ben-Shlomo Y, Cooper R, Kuh D. The last two decades of life course epidemiology, and its relevance for research on ageing. Int J Epidemiol 2016;45(4):973-988.

25. Pearce MS, Steele JG, Mason J, Walls AW, Parker L. Do circumstances in early life contribute to tooth retention in middle age? J Dent Res 2004;83(7):562-566.

26. Ramsay SE, Papachristou E, Watt RG, Lennon LT, Papacosta AO, Whincup PH et al. Socioeconomic disadvantage across the life-course and oral health in older age: findings from a longitudinal study of older British men. J Public Health (Oxf) 2018.

27. Delgado-Angulo EK, Bernabe E. Intergenerational mobility and adult oral health in a British cohort. Community Dent Oral Epidemiol 2015;43(3):255-261.

28. McCandless LC. Statin use and fracture risk: can we quantify the healthy-user effect? Epidemiology 2013;24(5):743-752.

29. Shrank WH, Patrick AR, Brookhart MA. Healthy user and related biases in observational studies of preventive interventions: a primer for physicians. J Gen Intern Med 2011;26(5):546-550.

30. Singh A, Rouxel P, Watt RG, Tsakos G. Social inequalities in clustering of oral health related behaviors in a national sample of British adults. Prev Med 2013;57(2):102-106.

31. Sanders AE, Spencer AJ, Stewart JF. Clustering of risk behaviours for oral and general health. Community Dent Health 2005;22(3):133-140.

32. Gilbert GH, Rose JS, Shelton BJ. A prospective study of the validity of data on self-reported dental visits. Community Dent Oral Epidemiol 2002;30(5):352-362.

Table 1. Characteristics of the study sample and comparison with the full sample of participants

Explanatory variables	All sample (n=6764)		Study sample (n=2970)	
	n[a]	%	n[a]	%
Sex				
Men	3161	48.8	1401	52.6
Women	3603	51.2	1569	47.4
Age groups				
16-24 years	853	13.7	357	15.4
25-34 years	1273	19.4	723	24.3
35-44 years	1219	18.3	632	21.0
45-54 years	1205	16.7	585	17.7
55-64 years	886	12.7	347	11.0
65-74 years	777	10.6	230	7.2
75+ years	551	8.6	96	3.5
Country				
England	3736	83.6	1746	85.0
Wales	890	5.0	394	4.8
Scotland	1294	8.7	514	7.8
Northern Ireland	844	2.7	316	2.4
Educational attainment				
No qualifications	1848	28.1	596	20.0
Below degree level	3523	58.1	1859	63.3
Degree level or above	819	13.8	515	16.7
Household income				
1st quintile (lowest)	1104	18.3	426	14.2
2nd quintile	1130	18.7	512	15.9
3rd quintile	1124	20.2	599	20.9
4th quintile	1101	20.2	684	22.7
5th quintile (highest)	1144	22.6	749	26.4
Social class				
I/II (highest)	2018	35.4	1188	38.8
IIM/IIINM	2607	44.3	1250	42.6
IV/V (lowest)	1283	20.3	532	18.6

[a]Counts are unweighted

Table 2. Characteristics of adults with different long-term pattern of dental attendance (n=2970)

Explanatory variables	Long-term pattern of dental attendance								p value[b]
	Always regular (n=887)		Current regular (n=978)		Former regular (n=824)		Never regular (n=281)		
	n[a]	%	n[a]	%	n[a]	%	n[a]	%	
Sex									<0.001
Men	273	34.6	493	54.9	468	63.8	167	61.4	
Women	614	65.4	485	45.1	356	36.3	114	38.6	
Age groups									<0.001
16-24 years	130	20.0	39	5.2	167	23.4	21	9.4	
25-34 years	181	18.7	226	23.2	260	32.1	56	18.5	
35-44 years	190	20.6	225	23.7	161	18.8	56	20.0	
45-54 years	182	19.4	226	20.5	137	14.5	40	13.6	
55-64 years	105	10.3	138	13.9	57	6.2	47	18.4	
65-74 years	74	7.6	86	8.8	30	3.7	40	12.6	
75+ years	25	3.4	38	4.6	12	1.3	21	7.5	
Country									0.003
England	518	85.5	601	86.2	482	84.6	145	81.3	
Wales	138	5.7	130	4.5	90	4.2	36	5.3	
Scotland	138	6.7	166	7.6	157	8.5	53	9.2	
Northern Ireland	93	2.2	81	1.8	95	2.7	47	4.2	
Educational attainment									<0.001
No qualifications	132	15.4	200	19.8	141	17.4	123	43.3	
Below degree level	583	66.9	576	60.7	563	67.1	137	49.0	
Degree level or above	172	17.7	202	19.6	120	15.5	21	7.7	
Household income									<0.001
1st quintile (lowest)	92	10.9	130	12.3	119	13.6	85	31.9	
2nd quintile	146	15.6	147	13.8	147	15.6	72	24.8	
3rd quintile	172	20.7	199	21.2	178	21.7	50	17.7	
4th quintile	232	25.6	220	22.0	183	23.1	49	15.1	
5th quintile (highest)	245	27.2	282	30.7	197	26.1	25	10.5	
Social class									<0.001
I/II (highest)	409	44.7	427	43.3	276	33.2	76	24.7	
IIM/IIINM	351	38.8	398	41.9	377	46.6	124	42.8	
IV/V (lowest)	127	16.5	153	14.8	171	20.2	81	32.5	
Untreated dental caries									<0.001
No	457	51.9	507	52.1	289	36.6	93	34.4	
Yes	430	48.1	471	47.9	535	63.4	188	65.6	
Periodontal disease									<0.001
No	523	59.6	503	51.8	488	61.6	121	39.6	
Yes	364	40.4	475	48.2	336	38.4	160	60.4	

[a] Counts are unweighted

[b] Chi-squared test used for comparison

Table 3. Regression models for the association of long-term patterns of dental attendance with number of teeth retained and having a functional dentition (n=2970)

	Model 1[a]		Model 2		Model 3	
Number of teeth	**RR[b]**	**[95% CI]**	**RR**	**[95% CI]**	**RR**	**[95% CI]**
Always regular	1.00	[Reference]	1.00	[Reference]	1.00	[Reference]
Current regular	0.97	[0.95-0.99]*	1.00	[0.98-1.02]	1.00	[0.98-1.02]
Former regular	1.01	[0.99-1.04]	0.97	[0.96-0.99]**	0.97	[0.96-0.99]**
Never regular	0.85	[0.80-0.90]***	0.93	[0.89-0.97]**	0.93	[0.89-0.97]**
	Model 1[a]		**Model 2**		**Model 3**	
Functional dentition	**OR[c]**	**[95% CI]**	**OR**	**[95% CI]**	**RR**	**[95% CI]**
Always regular	1.00	[Reference]	1.00	[Reference]	1.00	[Reference]
Current regular	0.63	[0.46-0.86]**	0.79	[0.54-1.17]	0.81	[0.54-1.18]
Former regular	0.98	[0.69-1.39]	0.54	[0.35-0.84]**	0.53	[0.34-0.83]**
Never regular	0.22	[0.15-0.32]***	0.36	[0.22-0.61]***	0.36	[0.22-0.60]***

[a] Model 1 was unadjusted, Model 2 adjusted for demographic (sex, age and country of residence) and socioeconomic factors (education, income and social class), and Model 3 also adjusted for untreated caries (any teeth with untreated caries) and periodontal disease (any teeth with LOA$\geq$4mm).
[b] Number of teeth was modelled using negative binomial regression and rate ratios (RR) are reported.
[c] Functional dentition was modelled using logistic regression and odds ratios (OR) are reported.
* p<0.05; ** p<0.01, *** p<0.001